



Neural correlates of memory in early childhood

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Introduction

- Episodic memory shows rapid development during early childhood
 - Children's memory for contextual details increases (e.g., Drummond & Newcombe, 2002; Riggins, in press).
 - Children's autobiographical memories become more reliable (e.g., Peterson et al., 2012).
- Multiple factors have been shown to contribute to these improvements, including
 - Narrative processing immediately following events
 - Executive functions, including controlling search / retrieval
- However, recent evidence suggests basic memory processes are also developing
 - Likely as a result of age-related changes in the neural substrates supporting memory (e.g., Ghetti et al., 2010)
- The goal of this research is to examine changes in neural substrate related to memory in early childhood.

Study 1 - Methods

Visits (Figure 1) occurred at the Neurocognitive Development Lab at the University of Maryland.

Figure 1



Encoding

- Children interacted with each toy with a researcher

Delay

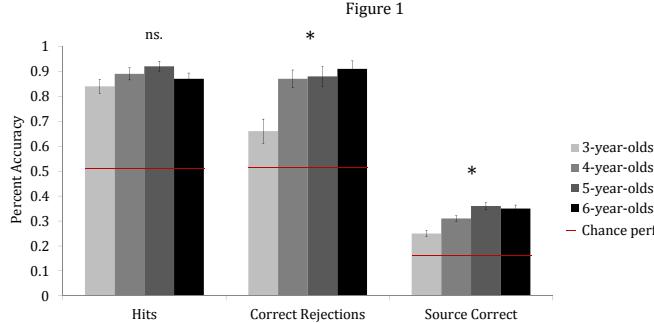
• 24-48 hours

Retrieval

- ERPs (Passive retrieval)
- Behavioral assessment of memory

Study 1 - Behavioral Results

Figure 1

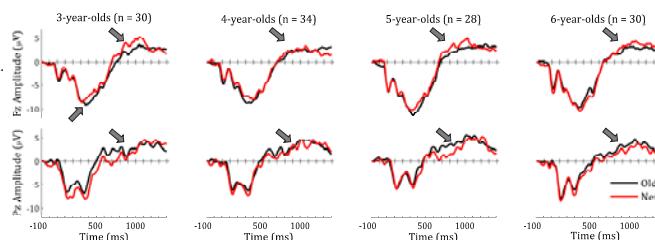


Study 1 - ERP Results

Do ERP responses to old and new stimuli vary as a function of age (Figure 2)?

- Age-related differences in old/new effects were only present in the negative component (Nc). Only 3-year-olds showed reliable old/new effects in the Nc.
- All age groups showed old/new effects in the positive slow wave (PSW). At frontal leads amplitude was larger for new than old items. At parietal leads the effect reversed and amplitude was larger for old than new items.

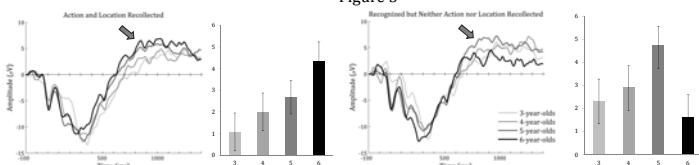
Figure 2



Does the ERP response differ between conditions that differentially engage recollection and familiarity?

- Recollection was indexed by
 - Memory for which location an object belonged
 - Memory for which action was associated with the object
- The PSW was sensitive to recollection
 - Amplitude to items recollected with both contextual details increased with age
 - Amplitude to items recognized but not remembered along with any contextual details increased between 3 and 5 years of age and then decreased to the lowest levels at 6 years

Figure 3



Study 2 - Behavioral and ERP Results

Were there behavioral differences between active and passive retrieval (Figure 4)?

- Children in the passive retrieval group had significantly more hits
- Active: Mean 94.1% SD = 4.8%
- Passive: Mean 97.3% SD = 2.8%
- No differences in correct rejections
 - Active: Mean 98.6% SD = 2.5%
 - Passive: 98.7% SD = 2.9%
- Overall memory performance very high

Figure 4

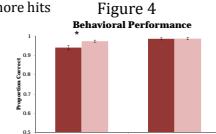
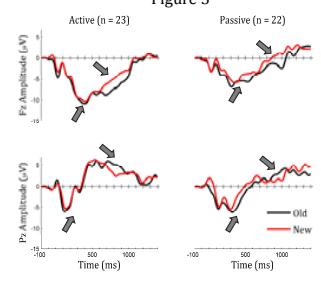


Figure 5



Discussion

- ERP recognition memory effects found in the Nc and PSW for both passive and active retrieval were identical to those found in Study 1, suggesting lack of age-related differences were not due to the paradigm.
- All children excluded from analysis in Study 2 were due to excessive movement during the active condition. Thus, there may be benefits using passive paradigms in future ERP studies of memory.

Additional Questions of Interest

- We are currently investigating differences between *active* and *passive* memory retrieval using a *source memory paradigm* to determine the effect of different retrieval processes on recollection.
- Studies 1 & 2 utilized memory for *objective* and verifiable details as indices of recollection. However, in adults recollection is most often assessed using Tulving's (1985) remember/know paradigm, a task that assesses recollection by participant's *subjective* reports. We are currently investigating ERP correlates of subjective recollection at encoding and retrieval in children, adolescents, and adults.
- We are currently examining *structural changes* in neural correlates of memory in early childhood.
 - Results from this work suggest the hippocampus, which plays a critical and irreplaceable role in memory, shows age-related differences between 4 and 6 years of age
 - Volume of the hippocampus is related to memory for contextual details in 6, but not 4 year olds.

Acknowledgements

The authors would like to thank the families who participated in these research studies and the members of the Neurocognitive Development Lab for assistance with data collection and analysis. Support for this research was provided by NIH R03 HD067425 (PI: Riggins).

References

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